

IN THE CLAIMS:

Please cancel without prejudice claims 29 through 33.  
Also kindly change claims:

1 through 9,  
11 and 12,  
18 through 21,  
23 through 28, and  
34 through 40

— all to read as follows.

1 1. (currently amended) Apparatus for printing a desired  
2 image on a printing medium, based upon input image data,  
3 by construction from individual marks of at least one col-  
4 orant, formed in a pixel grid; said apparatus comprising:  
5 for each colorant, at least one respective multiele-  
6 ment printing array that is subject to mark-intensity  
7 colorant-deposition errors of individual printing ele-  
8 ments; , including error in image intensity  
9 means for measuring mark-intensity ~~such colorant-~~  
10 ~~deposition~~ errors of the at least one array;  
11 means for modifying, without entirely replacing, a  
12 preexisting multicolumn, multirow numerical tabulation  
13 that defines forms an intensity correspondence mapping  
14 between such input image data and such marks, to compen-  
15 sate for the measured mark-intensity colorant-deposition  
16 errors , including error in image intensity ; and  
17 means for printing using the modified tabulation  
18 mapping.

1 2. (currently amended) The apparatus of claim 1, where-  
2 in:

3 the apparatus has printing resolution on the order  
4 of 450 marks per inch; and

5 the apparatus has mark-positioning addressability on  
6 the order of 450 marks per inch, or less

7  
8 ~~the mapping is selected from the group consisting of: an~~  
9 ~~optical-density transformation of the image data to such~~  
10 ~~construction from individual marks; and a spatial-resolu-~~  
11 ~~tion relationship between the image data and such pixel~~  
12 ~~grid.~~

1 3. (currently amended) The apparatus of claim 2, where-  
2 in:

3 the optical-density transformation comprises a ren-  
4 dition-thresholding dither halftoning matrix

5  
6 ~~, and the spatial-resolution relationship comprises a~~  
7 ~~scaling of the image data to such pixel grid.~~

1 4. (currently amended) The apparatus of claim 2 [[1]],  
2 wherein:

3 the optical-density transformation comprises an  
4 error-diffusion thresholding hierarchy

5  
6 ~~said at least one multielement printing array comprises a~~  
7 ~~plurality of multielement printing arrays that print in a~~  
8 ~~corresponding plurality of different colors or color di-~~  
9 ~~lutions, respectively, each multielement printing array~~  
10 ~~being subject to a respective colorant-deposition error,~~  
11 ~~and the measuring means and the mapping-modifying means~~  
12 ~~each operate with respect to each one of the plurality of~~  
13 ~~multielement printing arrays respectively.~~

1 5. (currently amended) The apparatus of claim 2 [[4]],  
2 wherein:

3 the number of individual marking elements in use,  
4 divided by the number of rows in the tabulation, equals  
5 an integer;

6 the tabulation is one- or two-dimensional only;

7 for at least one of the plurality of multielement  
8 printing arrays, the mark-intensity colorant-deposition  
9 error comprises a respective pattern of printing-[[d]]  
10 intensity defects; and wherein:

11 the measuring means comprise means for measuring the  
12 pattern of mark-intensity printing-density defects for  
13 each multielement printing array respectively; and

14 the modifying means comprising means for applying  
15 the respective pattern of defects, for at least one of  
16 the multielement printing arrays, to modify a respective  
17 said tabulation mapping.

1 6. (currently amended) The apparatus of claim 1 [[4]],  
2 wherein:  
3 ~~for at least one of the plurality of multielement~~  
4 ~~printing arrays, the colorant-deposition error comprises~~  
5 ~~a swath-height error;~~  
6 the measuring means comprise means for measuring  
7 mark-intensity ~~the swath-height~~ error for one or more  
8 groups of printing elements, each group being fewer than  
9 all the elements, of each multielement printing array re-  
10 spectively; and  
11 the modifying means comprise means for applying the  
12 respective mark-intensity ~~swath-height~~ error, for at  
13 least one of the multielement printing arrays, to modify  
14 a respective said tabulation mapping.

1 7. (currently amended) The apparatus of claim 1, where-  
2 in:  
3 the mark-intensity ~~colorant-deposition~~ error com-  
4 prises a pattern of printing-density defects;  
5 the measuring means comprise means for measuring the  
6 pattern of printing-density defects;  
7 the modifying means comprise:  
8  
9 means for deriving a correction pattern from  
10 the measured pattern of printing-density  
11 defects, and  
12  
13 means for applying the correction pattern to  
14 modify a halftone thresholding process;  
15 and  
16  
17 for each colorant, the printing means comprise means  
18 for printing such image incrementally, using the modified  
19 halftone thresholding process.

1 8. (currently amended) The apparatus of claim 1, where-  
2 in:  
3 ~~the colorant-deposition error comprises a swath-~~  
4 ~~height error or otherwise corresponds to an optimum dis-~~  
5 ~~tance of printing-medium advance;~~  
6 the measuring means comprise means for measuring  
7 mark-intensity the swath-height error for individual  
8 printing elements, individually, of at least one of the  
9 multielement printing arrays, respectively or determining  
10 the optimum distance; and  
11 the modifying means comprise:  
12  
13 means for deriving a correction pattern from  
14 the measured mark-intensity swath-height  
15 error or determined optimum distance, and  
16  
17 means for applying the correction pattern to  
18 modify the tabulation  
19  
20 ~~a halftone thresholding process ; and for each colorant,~~  
21 ~~the printing means comprise means for printing such image~~  
22 ~~incrementally, using the modified halftone thresholding~~  
23 ~~process.~~

1 9. (currently amended) A method of printing a desired  
2 image, by construction from individual marks of at least  
3 one colorant, formed in a pixel grid by at least one mul-  
4 tielement printing array that is subject to a pattern of  
5 printing-density defects, including error in mark image  
6 intensity of individual printing elements, considered in-  
7 dividually; said method comprising the steps of:  
8       measuring mark-intensity error ~~such pattern of~~  
9 ~~printing-density defects~~;  
10       deriving a correction pattern from the measured pat-  
11 ~~tern of printing-density defects, including error in~~  
12 ~~image intensity~~;  
13       applying the intensity-error correction pattern to  
14 correct the error, by modifying a halftone thresholding  
15 process that uses a halftoning matrix which is a prede-  
16 fined numerical array;  
17       wherein the applying step comprises preparing a mod-  
18 ified form of the predefined numerical array, based upon  
19 the intensity-error correction pattern, and then using  
20 that modified form of the array; and  
21       for each said colorant, printing such image by said  
22 at least one multielement array respectively, using the  
23 modified halftone thresholding process modified on the  
24 basis of the intensity-error correction pattern.

1 10. (previously presented) The method of claim 9, for  
2 use with a printmask in plural-pass printing, said print-  
3 mask being a defined system of numerical values, distinct  
4 from the measured pattern of defects and distinct from  
5 the derived correction pattern, that establishes the  
6 printing pass in which each ink mark is to be made; and  
7 further comprising the steps of, before or as a part of  
8 the applying step:

9       using such printmask to determine a relationship be-  
10       tween the halftone matrix and the multielement array; and  
11       employing the relationship in the applying step to  
12       control application of the correction pattern to the  
13       halftone matrix.

1 11. (currently amended) The method of claim 9, wherein:  
2       the printing step comprises cooperation between plu-  
3 ral single-pass printing elements that mark in a single  
4 common color, to form marks that together define a single  
5 common small region of such image. in said common color.



1 12. (currently amended) The method of claim 9, wherein:  
2 the method comprises no positional-error feedback to  
3 modify positional addressing of image data in relation to  
4 the pixel grid

5  
6 ~~for use with said at least one multielement incremental-~~  
7 ~~printing array that comprises a plurality of scanning~~  
8 ~~multielement printing arrays that print in a correspond-~~  
9 ~~ing plurality of different colors or color dilutions,~~  
10 ~~each multielement printing array being subject to a re-~~  
11 ~~spective swath height error; and wherein: the measuring,~~  
12 ~~deriving, applying and printing steps are employed to~~  
13 ~~modify swath height of at least one of the scanning mul-~~  
14 ~~tielement printing arrays, for accommodating any swath~~  
15 ~~height error present in each multielement printing array~~  
16 ~~respectively.~~

1 13. (original) The method of claim 9, for use with said  
2 at least one multielement incremental-printing array that  
3 comprises a plurality of multielement printing arrays  
4 that print in a corresponding plurality of different col-  
5 ors or color dilutions, each multielement printing array  
6 being subject to a respective pattern of printing-density  
7 defects; and wherein:  
8 the measuring, deriving, applying and printing steps  
9 are each performed with respect to each multielement  
10 printing array respectively.

1 14. (original) The method of claim 13, for use with  
2 such plurality of multielement incremental-printing ar-  
3 rays that are also each subject to a respective swath-  
4 height error; and wherein:  
5 the measuring, deriving, applying and printing steps  
6 are also employed to modify swath height of at least one  
7 of the multielement printing arrays, for accommodating  
8 any swath-height error present in each multielement  
9 printing array respectively.

1 15. (original) The method of claim 9, wherein:  
2 the halftone thresholding process comprises defini-  
3 tion of a halftone matrix.

1 16. (original) The method of claim 9, wherein:  
2 the halftone thresholding process comprises an  
3 error-diffusion protocol.

1 17. (original) The method of claim 16, wherein the  
2 error-diffusion protocol comprises at least one of:  
3 a progressive error-distribution allocation protocol  
4 of such error-diffusion halftoning; and  
5 a decisional protocol for determining whether to  
6 mark a particular pixel.

1 18. (currently amended) The method of claim 9, wherein:  
2 the applying step comprises replacing error diffu-  
3 sion or halftoning threshold values above or below a par-  
4 ticular threshold value.

1 19. (currently amended) The method of claim 9, wherein:  
2 the applying step comprises multiplying error diffu-  
3 sion or halftoning threshold values by a linear factor.

1 20. (currently amended) The method of claim 9, wherein:  
2 the applying step comprises applying a gamma correc-  
3 tion function to error diffusion or halftoning threshold  
4 values.

1 21. (currently amended) The method of claim 9, wherein  
2 the modifying step comprises a combination of at least  
3 two of:  
4 replacing error diffusion or halftoning threshold  
5 values above or below a particular threshold value;  
6 multiplying each error diffusion or halftoning  
7 threshold value [[s]] by a linear factor; and  
8 applying a gamma correction function to error diffu-  
9 sion or halftoning threshold values.

1 22. (original) The method of claim 9, wherein:  
2 for each of the plurality of multielement arrays,  
3 the measuring, deriving and applying steps are each per-  
4 formed at most only one time for a full image.

1 23. (currently amended) The method of claim 9, wherein:  
2 the printing elements have a spacing along the ar-  
3 ray; and  
4 the printing step proceeds with a positioning preci-  
5 sion and addressability that is coarser than or equal to  
6 said printing-element spacing along the array  
7  
8 ~~the applying step comprises modifying the darkness~~  
9 ~~of substantially each mark printed by an individual~~  
10 ~~printing element whose density is defective.~~

1 24. (currently amended) The method of claim 9, wherein:  
2 the applying step comprises modifying the average  
3 number of marks ~~dots~~ printed by an individual printing  
4 element whose mark ~~[[d]]~~ intensity is defective.

1 25. (currently amended) A method of printing a desired  
2 image, based on input image data, by construction from  
3 individual marks of at least one colorant, formed in a  
4 pixel grid by at least one scanning multielement printing  
5 array; said printing being subject to ~~print-quality de-~~  
6 ~~fects due to departure of printing-medium advance from an~~  
7 ~~optimum value, and also including error in mark image in-~~  
8 ~~tensity of individual printing elements, considered indi-~~  
9 ~~vidually;~~ said method comprising the steps of:  
10       measuring mark-intensity error ~~a parameter related~~  
11 ~~to such print-quality defects;~~  
12       based on the measured mark-intensity error param-  
13 ~~eter, compensating for the intensity error without modi-~~  
14 ~~fying position of particular marks relative to such pixel~~  
15 ~~grid, or to any ideal form of such pixel grid~~  
16  
17 ~~scaling such input image data to compensate for said de-~~  
18 ~~parture, and for each said colorant, printing such marks~~  
19 ~~with said at least one scanning multielement array using~~  
20 ~~the scaled input image data.~~

1 26. (currently amended) The method of claim 25, where-  
2 in:  
3 said scanning multielement printing arrays are at  
4 least two in number;  
5 each printing array forms a pixel grid that is at  
6 least partially different from a pixel grid formed by  
7 each other printing array, and from any ideal form of  
8 such pixel grid; and  
9 aside from linear alignment, no step of the method  
10 is directed to regularizing the pixel grids to one anothe-  
11 er or to such ideal form  
12  
13 ~~the parameter comprises such print-quality defects, and~~  
14 ~~the measuring step comprises measuring such print-quality~~  
15 ~~defects.~~

1 27. (currently amended) The method of claim 25 [[26]],  
2 wherein:  
3 the compensating step comprises the step of adjust-  
4 ing thresholds of a preexisting tabulation that forms a  
5 relationship between said input image data and the indi-  
6 vidual printed marks,  
7 said threshold-adjusting step statistically increa-  
8 ses or reduces usage of printing elements associated with  
9 said mark-intensity error, thereby increasing or decreas-  
10 ing total numbers of marks in image regions associated  
11 with those printing elements  
12  
13 ~~the defects comprise swath-height error, and the measur-~~  
14 ~~ing step comprises measuring swath-height error.~~

1 28. (currently amended) The method of claim 25 [[26]],  
2 wherein:

3 the measuring step comprises measuring mark-inten-  
4 sity error of printing elements considered as groups,  
5 said groups being fewer than all the printing elements  
6 for any given color

7  
8 ~~the defects comprise area-fill nonuniformity, and the~~  
9 ~~measuring step comprises: using a sensing system to~~  
10 ~~measure area-fill nonuniformity for plural printing-medi-~~  
11 ~~um advance values, and selecting a printing-medium ad-~~  
12 ~~vance value that corresponds to minimum area-fill non-~~  
13 ~~uniformity.~~

29 through 33. (canceled)

1 34. (currently amended) Apparatus for printing a de-  
2 sired image on a printing medium, based upon input image  
3 data, by construction from individual marks formed in a  
4 pixel grid; said apparatus comprising:  
5 at least one multielement incremental-printing array  
6 that is subject to colorant-deposition error, including  
7 error in mark image intensity of individual printing  
8 elements, considered individually;  
9 means for measuring mark-intensity ~~such colorant-~~  
10 ~~deposition~~ error of the at least one array;  
11 means for modifying a multicolumn, multirow numeri-  
12 cal tabulation, which that forms an intensity relation-  
13 ship mapping between such input image data and such  
14 marks, to compensate for the measured mark-intensity col-  
15 orant-deposition error , ~~including error in image inten-~~  
16 ~~sity~~; and  
17 means for printing using the modified tabulation  
18 mapping;  
19 wherein the multielement printing array is an inkjet  
20 printhead.



1 35. (currently amended) A method of printing a desired  
2 image, by construction from individual marks formed in a  
3 pixel grid by at least one multielement printing array  
4 that is subject to a pattern of printing-density defects,  
5 including error in mark image intensity of individual  
6 printing elements, considered individually; said method  
7 comprising the steps of:  
8       ~~measuring such pattern of printing-density defects,~~  
9       ~~including error in mark image intensity;~~  
10       deriving a correction pattern from the measured  
11 ~~mark-intensity error pattern of printing-density defects;~~  
12       applying the correction pattern to modify a halftone  
13 thresholding process that uses a halftoning matrix which  
14 is a predefined numerical array;  
15       wherein the applying step comprises preparing a  
16 modified form of the predefined numerical array, and then  
17 using that modified form of the array, to correct the er-  
18 ror in mark image intensity; and  
19       printing such image using the modified halftone  
20 thresholding process;  
21       wherein the multielement printing array is an inkjet  
22 printhead.

1 36. (currently amended) A method of printing a desired  
2 image, based on input image data, by construction from  
3 individual marks formed in a pixel grid by at least one  
4 scanning multielement printing array; said printing being  
5 subject to print-quality defects due to departure of  
6 printing-medium advance from an optimum value, and also  
7 including error in mark image intensity of individual  
8 printing elements, considered individually; said method  
9 comprising the steps of:  
10       measuring a parameter related to such print-quality  
11 defects;  
12       based on the measured parameter, scaling such input  
13 image data to compensate for said departure; and  
14       printing such image using the scaled input image  
15 data;  
16       wherein the multielement printing array is an inkjet  
17 printhead.

1 37. (currently amended) Apparatus for printing a de-  
2 sired image on a printing medium, based upon input image  
3 data, by construction from individual marks of at least  
4 one colorant, formed in a pixel grid; said apparatus  
5 comprising:  
6       for each colorant, respective means for printing  
7 incrementally in that colorant;  
8       each said printing means, for a particular one col-  
9 orant, comprising at least one respective incremental-  
10 printing array that is subject to colorant-deposition  
11 error, including error in mark image intensity of indi-  
12 vidual printing elements, considered individually;  
13       means for measuring mark intensity ~~such colorant-~~  
14 ~~deposition~~ error of the at least one array;  
15       means for modifying a multicolumn, multirow numeri-  
16 cal tabulation that forms an intensity relationship map-  
17 ping between such input image data and such marks, to  
18 compensate for the measured ~~colorant-deposition error,~~  
19 including error in mark image intensity;  
20       wherein the numerical tabulation is not a halftone  
21 screen; and  
22       means for printing using the modified tabulation  
23 mapping.

1 38. (currently amended) Apparatus for printing a de-  
2 sired image on a printing medium, based upon input image  
3 data, by construction from individual marks formed in a  
4 pixel grid; said apparatus comprising:

5 at least one multihundred-element printing array  
6 that is subject to colorant-deposition error, including  
7 error in mark image intensity of individual printing  
8 elements, considered individually;

9 means for modifying a multicolumn, multirow numeri-  
10 cal tabulation that forms an intensity relationship map-  
11 ping between such input image data and such marks, to  
12 compensate for the measured ~~colorant-deposition error,~~  
13 including error in mark image intensity; and

14 means for printing using the modified tabulation  
15 mapping.

1 39. (currently amended) The apparatus of claim 38,  
2 wherein:

3 the apparatus has printing resolution on the order of  
4 450 marks per inch;

5 the apparatus has mark-positioning addressability on  
6 the order of 450 marks per inch, or less, along at least one  
7 axis;

8 whereby the apparatus is incapable of hyperacuity  
9 operation;

10 the apparatus further comprises means for measuring  
11 intensity such ~~colorant-deposition error~~ of the at least  
12 one array; and

13 the multihundred-element array has at least three  
14 hundred printing elements.

1 40. (currently amended) Apparatus for printing a de-  
2 sired image on a printing medium, based upon input image  
3 data, by construction from individual marks formed in a  
4 pixel grid; said apparatus comprising:  
5 at least one multielement incremental printing  
6 array, having at least thirty printing elements, that is  
7 subject to colorant-deposition error, including error in  
8 mark image intensity of individual printing elements,  
9 considered individually;  
10 means for measuring intensity ~~such colorant-deposi-~~  
11 ~~tion~~ error of the at least one array;  
12 means for modifying a multicolumn, multirow numeri-  
13 cal tabulation, which that forms an intensity relation-  
14 ship mapping between such input image data and such  
15 marks, to compensate for the measured ~~colorant-deposition~~  
16 ~~error, including error in~~ mark image intensity; and  
17 means for printing using the modified tabulation  
18 mapping.

1 41. (previously presented) The apparatus of claim 40,  
2 wherein:  
3 the at least one multielement incremental printing  
4 array comprises a scanning printhead or a full-page-width  
5 printhead.

1 42. (previously presented) The apparatus of claim 40,  
2 wherein:  
3 the printing means comprise at least one micropro-  
4 cessor controlling all of the at least thirty elements  
5 simultaneously during printing to select, and selectively  
6 actuate, particular elements for printing of particular  
7 pixels respectively.